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AQUATIC RESOURCES NEWS

A REGULATORY NEWSLETTER

Headquarters, U.S. Army Corps of Engineers, Regulatory Branch

A Note from Headquarters

I would like to take some time to discuss the joint issues of budget and permit data from RAMS and ORM. As everyone should know, the last 2 years have been progressively more difficult as we have worked under a flattened budget. This year will be even more challenging as we enter our third year as we received only a small increase to our budget. While we are hurting, please recognize many other agencies received cuts in their budgets while we were one of the very few that received any increase.

While the prognosis for this year is not rosy, there are a few items that you should understand. First, the acting Assistant Secretary of the Army for Civil Works understands how hard you are working and is making members of Congress aware of the importance of the program. The regulatory program is one of his three priorities for the Corps. Second, OMB is appreciative of our new performance measures and our ability to link budget dollars with performance. This gives them and the Corps the ability to see the likely benefits of increasing our budget on the protection of aquatic resources through permit compliance and enforcement,while making environmentally sound permit decisions. While we will begin to track these new measures this year and hold people to the targets in FY 2006, the target levels will be based on the funds provided for that year. Clearly, levels will be reduced this year as we are working with reduced funds. Third, we are getting unsolicited broad support for additional funds for the program from both environmental and developer groups. Both groups understand the need for additional project managers to conduct compliance visits and make timelier permit decisions. So while this year is going to be difficult, we hope this broad support results in increased funds for FY 2006. Obviously, national priorities may intervene and we will continue to do the best we can with the funds we are provided.

That being said, I need everyone to understand the importance of the data you enter into RAMS or ORM. These data are critical as they are used to document our work effort and the time it takes to make permit decisions. Please be honest and accurate in your submissions and make it a priority in your work effort. Without data that accurately reflect what you do and how long it takes you to do it, I am inadequately armed to inform others what our program needs truly are. I do remember how hard it is to enter data with a pile of permits on your desk, but believe me, it does help the program. I hope everyone can make a New Year's resolution to improve data entry this year. My resolution, as always, is to try to get more funds for the program. Thanks and have a good year.

Mark Sudol
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A Note from the Editor

Many regulators do not get the chance to see and evaluate wetlands in other parts of the country. In this and upcoming issues, your fellow regulators will characterize wetlands and/or other waters in various parts of the country and discuss related regulatory issues. This issue focuses on montane wetlands.

Distribution of Aquatic Resources News
The *Aquatic Resources News* will be distributed to field staff by e-mail. The Newsletter will also be available on the IWR website within the month at:
http://www.iwr.usace.army.mil/iwr/regulatory/regulintro.htm
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Missouri Fens-Rare Ozark Mountain Wetlands

Danny McClendon

I remember the first time I saw a mucky, mineral soil. It was while I was attending the Regulatory IV Prospect course in Kalamazoo, Michigan, at the Kellogg Biological Station. Peat bogs are common in Minnesota, Michigan, and Wisconsin. So it came as a surprise one day when a landowner in the Ozarks of southeast Missouri called me and requested that I come down and look at a wet spot on his property. Looking at the NWI map for the area, I saw only steep Ozark hills with some stream courses nearby, but no wetlands. I was skeptical, but agreed to come and take a look. The landowner took me along the top of a steep Ozark ridge and then we angled downward toward a creek. At the base of the ridge, tucked into a little alcove, was a very wet, wetland. As I walked into this wetland it reminded me of the peat bogs I had seen up in Michigan. In fact, much of this small wetland was very mucky, and actually "quaked" when you walked on it. In addition, the vegetation was very unique, dominated by alder and swamp rose. As I pushed the soil probe in, the top layers were definitely organic muck. As I pushed the probe in further, it penetrated the upper layers and went three feet or so before I encountered a rich calcium carbonate sand and gravel layer. I delineated the area and told the landowner that he definitely had a wetland, but that I had never seen anything like it in this part of Missouri.

When I got back to the office I started doing some research on this part of Missouri and found that I had been in an Ozark fen (Figure 1). A fen is a rare, natural community in Missouri where soils are saturated from the upwelling of mineral-rich groundwater, creating spring rivulets and ooze areas. Missouri has several types of these areas in the Ozark Mountain Region. These include seep fens, deep muck fens, prairie fens, and forested fens. In the Ozarks, groundwater seeps are classified as either fens or acidic seeps, depending on whether their water chemistry is alkaline or acidic. In Missouri, fens are most often found in the karst landscapes of the Ozarks. Groundwater seeps are relatively rare and are most commonly found on steep narrow valley slopes, ravines, bases of bluffs, rock ledges, glades or rocky terraces.

Figure 1. Hattie's Ford Fen at Wappapello Lake, Missouri

Because of their cool temperatures and moist climates, fens often contain plants more typical of states to the north. Many of these plants are rare or endangered in Missouri. Several rare plants are even considered to be relicts from the last glacial period, when ice sheets covered north Missouri and the Ozarks. In the fen that I visited, there were plants I had never seen before. The diversity of plants in Missouri fens is very unique. Sedges, bulrushes, alder, willow, swamp rose, swamp orange coneflower, swamp wood betony, golden ragwort, cowbane, Grass of Parnassus, Michigan lily, ferns, swamp asters, rare or endangered orchids, harebells, marsh bellflowers, Queen of the Prairies, and marsh blue violets, umbrella grass, false nettle, orange coneflower, loosestrife, swamp dogwood, wild impatiens, marsh coneflower, fen goldenrod, and numerous tree species occur in the forested fens. Many fens exhibit tussocks of sedges and grasses and may even have quaking, mucky peat mats.

Ozark fens also have a diverse and unique assemblage of wildlife and insects. Because of their habitats, several rare species utilize these fens. The rare wood frog and four-toed salamander utilize these habitats. Many bird species utilize fens, due to their unique habitats and abundance of seeds and insects. The common yellowthroat, swamp sparrow, red-winged blackbirds, and the rare little blue heron may be seen. Frogs, crayfish, snapping turtles, muskrat, raccoon, beaver, mink and other wildlife utilize these important habitats as well. More recently, the Hines Emerald Dragonfly, a Federally listed endangered species (Figure 3), was discovered at the Grasshopper Hollow Natural Area in Reynolds County, Missouri. This area contains the largest and most unique complex of fen communities in the Ozarks and is now a Missouri Natural Area to help preserve this habitat and endangered species. The Hines Emerald Dragonfly is currently found only in Illinois, Wisconsin, Michigan, and Missouri.

Figure 3 - Hine's Emerald Dragonfly

However, all things are not rosy for fens in Missouri. Never common in presettlement times, most fens are limited to only a few counties in southeast Missouri. Many of these areas are now becoming extremely rare. Many deep muck fens in Missouri have a notorious reputation, being called the "Quicksand of the Ozarks". Many locals consider them quaking bog-like places where cattle and man find it difficult to traverse. When you find a deep muck fen there are local legends about how many cows (and maybe people) that have disappeared in these fens. Therefore, many fens have been drained, excavated and eliminated from the landscape. Many fens are threatened by forest clearing and logging, over grazing, road construction, draining, and excavation to form fishponds.

After finding out what type of wetland I had seen, I contacted the landowner and informed him that he had a rare fen on his property and that it deserved his protection and care. He said he wanted to know if he needed a permit to dig it out and make a trout pond out of it! I told him he did and suggested that he contact someone from the state to see if he might get some sort of compensation for enrolling his fen as a natural area. To date this unique fen has not been disturbed by the landowner.

I have since documented several other fens in the Ozarks in southeast Missouri and each has its own unique soil, plant, animal and hydraulic characteristic. As for delineating fens, it is not difficult. The area almost always has standing water, hydrophytic plants, and organic or gleyed soils. However, due to their small size they may go unnoticed on many maps. In addition, many of these small seeps and fens may be considered to be "isolated" due to their location in the landscape and lack of a good surface water connection. Due to their small size, impacts to these seeps and fens may qualify for nationwide permits. Therefore, Corps Districts in Missouri have placed a regional condition on the nationwide permits that requires anyone proposing to impact a fen to notify the Corps, no matter what size the fen. This allows us to possibly exclude fens from nationwide permit authorization and to take discretionary authority to require a more detailed analysis of impacts.

(Danny McClendon is Chief of the Regulatory Branch, St. Louis District. Prior to becoming the Branch Chief, he was a Project Manager for 9 years, working mostly in southeast Missouri.)

Mountaintop and Sideslope Wetlands in New England

Marty Lefebvre and Ruth Ladd

New Hampshire has the White Mountains and Vermont has the Green Mountains. Both areas provide challenges to regulators - as well as beautiful fall foliage for leaf-peepers and excellent downhill skiing!

Many of the mountain sideslope wetlands that we see are seep-fed (Figure 1). Any watercourses generally have steep gradients so riparian wetlands are not common (Figure 2). When riparian wetlands do occur, they usually form a relatively narrow band along a stream (Figure 3).

Many of these sideslope wetland soils are shallow to bedrock or to glacial till (Figure 4). Determining wetland boundaries can be difficult because of these shallow soils. Another problem is that water flows parallel to the soil surface through the soils of the steep slopes very quickly, often resulting in saturated but aerated soils which may have hydrophytic plant communities but may not have soils which exhibit hydric characteristics. The following is from the 87 Manual section on soils:

The unique characteristics of hydric soils result from the influence of periodic or permanent inundation or soil saturation for sufficient duration to effect anaerobic conditions.Prolonged anaerobic soil conditions lead to a reducing environment, thereby lowering the soil redox potential. This results in chemical reduction of some soil components (e.g., iron and manganese oxides), which leads to development of soil colors and other physical characteristics that usually are indicative of hydric soils.

Figure 1. Sidehill Seep (photo by Joe Homer)

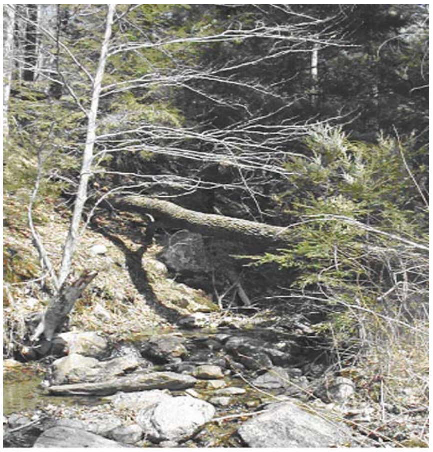

Figure 2. Mountain stream emerging from dense evergreen cover (photo by Ruth Ladd).

Figure 3. Umbagog Stream (photo by Joe Homer).

These areas may have long-term or permanent soil saturation but the rapid movement of the water often precludes the development of anaerobic conditions and therefore the chemical changes and resultant morphologies typically associated with wetland soils. Some of these areas may be wetlands. Clues used in these situations include looking for shallow rooting (beyond what may be caused by bedrock or boulders), noting proximity laterally and horizontally to watercourses, and looking for subtle soil morphologies such as increased accumulation of carbon (compared to surrounding areas) and faint redoximorphic features. There may be small (or even very small) pockets where the water is slowed down by concave features long enough for the water to become anaerobic. These areas would likely be interspersed with convex areas. Professional judgment would have to be used to determine the dominant condition. The photo below shows one area near the center, which might be a concave area with hydric soils. If an area actually ponds water for at least two weeks during the growing season, it would be a hydric soil by definition.

Figure 4. Shallow soils of sideslope wetland (photo by Joe Homer).

Vegetation in these slope wetlands includes *Abies balsamea* (balsam fir), *Picea rubens* (red spruce), *Picea mariana* (black spruce), *Betula alleghaniensis* (yellow birch), *Viburnum alnifolium* (hobblebush), *Fagus grandifolia* (American beech), and *Acer rubrum* (red maple), as well as *Sphagnum spp.* It's not unusual to find large clumps of stinging nettle (*Urtica dioica*) in the upland areas of these mountainsides. Long pants and a long-sleeved shirt make an unexpected jaunt through one of these areas far less unpleasant. Depending on the elevation, alpine vegetation may also be encountered.

Figure 5. Tecumseh Brook at Waterville Valley in the White Mountain National Forest.

The seep wetlands that are not associated with a watercourse may be isolated which involves the challenges associated with making adjacent versus isolated calls.

Because of the steepness and inaccessibility, most of the impacts that are proposed to these wetlands are for ski area-related projects such as new or widened ski trails, supports for lift lines, snowmaking pipelines, or base area development.

Because of their remote locations, we do not actually visit many of these wetlands, relying instead on the wetland consultants' expertise. Often the only way in involves a long hike, or a ride on an ATV or snowmobile. Rarely is there vehicular access nearby, except in the event of base area development where the slopes are gentler and the landscape is no longer considered "mountainside".

Occasionally we encounter a larger natural depression or "bowl" where a bog has formed in the otherwise mountainous landscape. The senior author tells this story of one of these areas: "*When I was working on Waterville Valley Ski Area's expansion several years ago, I was in one of these depressional areas with the ski area's wetland consultants. We looked up to see a young cow moose staring at us from several hundred feet away. We decided to walk closer to get pictures. We got within a hundred feet or so of the moose when she decided she had had enough of us. She started walking toward us, and we quickly decided we had enough pictures for the day. The moose ambled off into the forest soon after.*"

(Ruth Ladd is a senior wetland scientist in the Environmental Resource Section for the New England District Regulatory Branch. Marty Lefebvre is a senior project manager for the northern New England Permits and Enforcements Branch for the New England District.)

The Highs and Lows of Wetland Delineation within the Southern Rockies

Van Truan and Rudolph C. Villarreal

Wetlands in the Southern Rockies of Colorado occur from the high mountains to the semi-arid lowlands (Figure 1). Common wetland types in the region include wet meadows; fens; alpine snow glades; irrigated tail water lands; hillside seeps and springs; and streamside riparian and herbaceous flood plains.

This region's geography has a direct effect on the occurrence and commonness of wetlands. The annual growing season in this region can vary from six months to 30 days. Snow may occur at anytime at higher elevations and killing frosts can occur as late as July or as early as mid-August. Getting to a site during the growing season normally isn't too difficult, but in some years, snowfall may begin in high elevation wet meadows in September and can last into June during other years. Winter mountain wetland determinations are almost impossible. As regulators, we always let the applicant dig the holes in winter.

Within 60 miles, annual precipitation can change from seven inches to more than 35 inches. Elevation and location relative to the mountains normally affects the amount of precipitation a region receives. For example, the driest area of the state is the San Luis Valley in Southern Colorado, which is mostly surrounded by mountains. The precipitation falls in the mountains and rarely gets to the valley floor. Interestingly though, the valley contains some of the regions largest wetlands due to artesian groundwater surfacing.

Figure 1. Leadville, Colorado (photo by Rudy Villarreal)

Climate and vegetation characteristics can be described by an altitudinal zonation classification scheme, or life zones in Colorado. This zonation is especially pronounced owing to the wide range in elevation in this region, which varies from 14,433 feet on Mt. Elbert to 3,386 feet elevation at Holly. The Southern Rockies can be divided into the following five life zones:

The Upper Sonoran Zone occurs from approximately 3,500 ft to 7,000 ft and is located mostly in eastern Colorado and New Mexico (Figure 2). Wetlands in this zone include streamside cottonwoods and willows, with evasive Russian olive and salt cedar, hillside seeps, and irrigation related lands. Common wetland plants are coyote willow, cattails, bulrush, numerous grasses and sedges. Wildlife includes muskrat, bullfrog, Woodhouse toad, rails, marsh wren, common yellowthroat and numerous aquatic invertebrates.

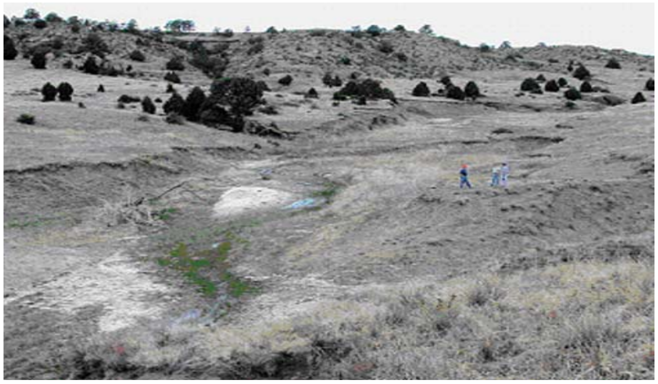

Figure 2. Upper Sonoran Zone, Jimmy Camp Creek, El Paso County, Colorado (photo by Van Truan)

The Transition Life zone occurs from approximately 6,000 to 9,000 feet (Figure 3). Wetlands within this zone are similar to the lower elevations, but include wet meadows, irrigated grassland, fens, and springs. Common wetland plants include Nebraska sedge, Baltic rush, wild iris, cinquefoils, and many other herbaceous plants. Wildlife includes beaver, water ouzel, dusky flycatcher, leopard frog, and many other species.

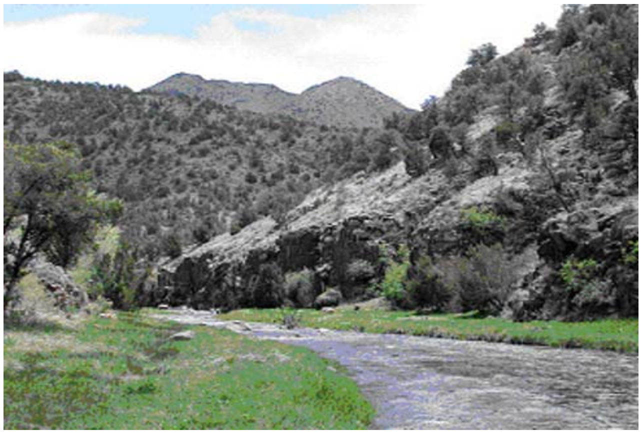

Figure 3. Transition Zone, Grape Creek, Fremont County, Colorado (photo by Van Truan)

The Canadian Zone occurs from about 7,500 to 9,500 feet. Wetlands consist of wet meadows, fens, riparian flood plains, and irrigated lands (Figure 4). Wetland plants include monkshood, monkey flower, several "blue-stem" willows, and other species. Wildlife found in this zone include, Lincoln's sparrow, MacGillivray's warbler, voles, the "rare" boreal toad, and many other species.

Figure 4. Canadian Zone, Wet Mountain Valley, Fremont County, Colorado (photo by Van Truan)

The Hudsonian Zone occurs from about 9,500 to 11,500 feet, and is dominated by fir and spruce forests, with wet meadows, seeps, snowfield melt areas, and streamside wetlands (Figure 5). Plants include false helborne, Parry primrose, several paintbrushes, sedges and rushes. Wildlife includes introduced moose, Wilson's warbler, white-crowned sparrow, and other species.

The Alpine zone, above 11,500 feet depending on latitude, is a zone made up of grasses, sedges, herbaceous plants and dwarf-willows called tundra. Wetlands occur mostly in snowmelt areas, adjacent to alpine lakes and streams. Plants include alpine marigold, numerous rushes and sedges, and stunted willows. Wildlife includes water pipit, ptarmigan, pica, elk, and others.

Problems facing regulators in this region of southern Colorado include delineation of wetland boundaries, adjacency, growing seasons, moisture regimes, and connectivity to tributary waters, determination of jurisdiction over ditches, irrigation tail water, mitigation, and water right issues.

Figure 5. Hudsonian Zone, Rio Grande National Forest, Conejos County, Colorado (photo by Van Truan)

In some cases, wetland delineations are as easy as looking at vegetation and contours. Other times, especially during drought years, finding evidence of wetland hydrology can be quite difficult. Wetland boundaries can change, sometimes drastically, with vegetation changes. The drought in the region for the last seven years has resulted in shifts of some wetland boundaries because wetter plants, FACW and FAC, have died. Annual FAC- to UPL and some perennial plants are replacing them, so the wetland boundaries have retreated. During wet periods, these areas normally will return to jurisdiction, but permitting during this time can be controversial.

This region, especially the Upper Sonoran zone, is semi-arid, and thus, wetlands usually occur adjacent to streams and irrigation reservoirs. With narrow flood plains, the wetlands associated with streams do not extend out from the streams (Figure 6).

Many wetlands within the flood plain, are not associated with a river, but instead with a hillside seep that may not flow to the stream. These areas may be flooded occasionally, but are not maintained by this overbank flooding. Many are not associated with smaller tributaries, and appear to be isolated from jurisdictional tributaries.

Irrigation tail water wetlands are some of the most difficult to determine jurisdiction. Winter snows and some "monsoon" rains during summer contribute to flows in most streams in the region. This water is stored in large irrigation reservoirs or conveyed by irrigation ditches directly to agricultural lands. The low end of fields can retain enough water to form wetlands and determining whether these are regulated requires the Corps to work closely with the Natural Resource Conservation Service.

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Figure 6. Purgatoire River, Las Animas County, Colorado (photo by Van Truan)

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Many times we have required construction of wells and at least one year of monitoring in order to determine if the hydrology of a site was associated with irrigation. Many wetlands are formed because of leaky irrigation ditches. These wetlands have to be reviewed similarly to tail waters to determine jurisdiction.

Mitigation within the region for impacts to wetlands can be difficult. In the western states, water rights are like gold, a valuable commodity that can be sold or bought without owning the land. This makes the costs of mitigation high Depending on the state regulations may not allow a change of use of the water without going to water court. Certain wetland types are impossible to mitigate. Fens are mostly organic and form very slowly, and at this time are almost impossible to replace with the same wetland type. Some research is taking place to determine if reusing fen organic material can be used to mitigate fen impacts.

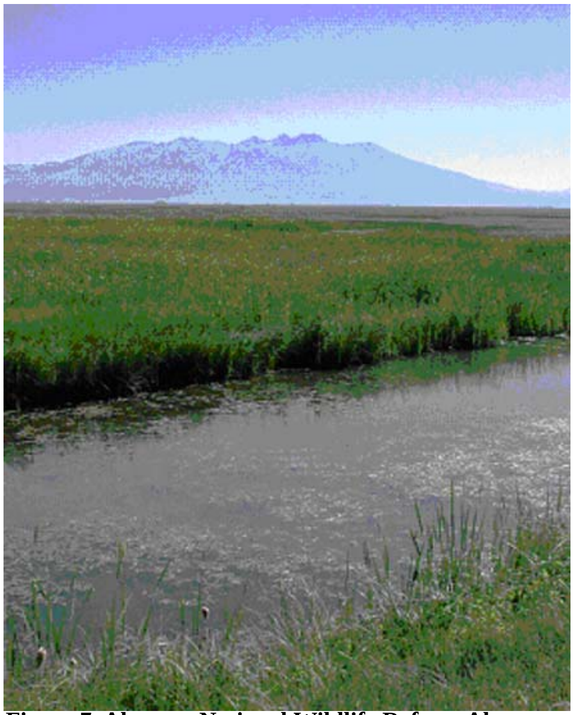

Figure 7. Alamosa National Wildlife Refuge, Alamosa County, Colorado (photo by Van Truan)

(Van Truan is Chief of the Albuquerque District's Southern Colorado Regulatory Office in Pueblo. Rudolph Villarreal is project manager in the Southern Colorado Regulatory Office. (Editor's note: Van and Rudy have won numerous district awards for the photography; their photographs can be viewed on the district website under "Photo Library.")

The Cascade Range of the Pacific Northwest

Jim Goudzwaard

The mountainous Cascade Range runs about 700 miles north to south roughly from southwestern British Columbia to the northern California Shasta-Cascade area. In the United States, this region famous for its chain of tall volcanoes is called the High Cascades or Cascades while the smaller British Columbia region is known as the Cascade Mountains. The large metropolitan areas of Seattle and Portland are both located just west of the Cascades.

Geographically, the Cascades are 30 to 50 miles wide at the southern end and about 80 miles wide in the north. While the Cascades reach elevations of about 4500 to 5000 feet high in the south, much higher peaks are found in the northern portion. North of Mt. Rainier and east of Seattle, the range is very rugged with many steep and glaciated peaks. The present range resulted from uplift and volcanism during the past 10 million years. During the Pleistocene Epoch, glaciers covered most of the region.

Many of the dormant volcanoes tower from 10,000 to over 14,000 feet - Mt. Rainier is visible on a clear day (not very often in the Pacific northwest) from the Portland area - over 100 miles away!

Because the Cascade Range is near the Pacific Ocean (75-100 miles), precipitation is quite heavy on the western slopes. Most rainfall occurs between October and April averaging 30 to 150 inches per year. On the higher Cascade mountains, and especially in the north, most precipitation falls as snow reaching depths of 50 to 65 feet. Many of these high mountains retain their snow pack all year (Olympic skiing hopefuls train on Mt. Hood all year - See Figure 1). While the western slopes receive ample rain, the eastern slopes are much drier with less than 20 inches of precipitation accumulating per year. Thus, the Cascades in Washington and Oregon form a natural barrier between the moist western portions and the dry eastern parts of these States. Although rainfall is heavy on the western slopes and less on the eastern slopes, the potential for extensive summer and fall forest fires is very high.

Figure 1. Subalpine Intermittent Stream and Snow-covered Wetland in June. Mt. Hood is in the background (photo by Roger Borine)

The Cascade Range is almost entirely forested with dense conifer forests of Douglas fir and western hemlock up to about 3,000 feet, silver fir and mountain hemlock up to 6,000 feet, and transitioning into higher elevation plant communities of Alaska yellow cedar, sub alpine fir and white bark pine. At the highest alpine elevations, plant communities consist of dwarf shrubs and herbs interspersed with areas of perpetual snow or rock. There are lush meadows, pristine wetlands, sparkling lakes and scenic rivers within these forests (Figure 2).

During spring snow melts, lower elevation riparian areas (dominated by black cottonwood, alder, ash, willow, dogwood, and Douglas spiraea) along streams and rivers drain the Cascades to major waterways that eventually lead to the Pacific Ocean. At times, these melts occur so rapidly that stream erosion and sediment deposition creates problems for downstream properties.

Figure 2. A Low-Gradient High Mountain Pond and Associated Wetland (photo by Roger Borine)

The dry eastern slopes of the Cascades have plant communities that transition from true firs in the higher elevations with its higher precipitation to drier ponderosa pine and lodgepole pine forests. Soils of the Cascades are greatly influenced by volcanic activities. Andisols are extensive where parent material is highly influenced by volcanic ash. Inceptisols occur throughout the range where volcanic activity is less prevalent. As much of the Cascade Range is in public ownership, large parts of the forested areas have no soils surveys completed by the National Resources Conservation Service.

Fauna of the Cascades are varied. Large mammals consist of elk, deer, mountain lion, bobcat, coyotes and black bear (Figure 3). Grizzly bear are found in limited numbers in the northern Washington part of the range. Although not normally a Clean Water Act regulatory problem, American bald eagle, spotted owl and marbled murrelet (all Endangered Species Act species) frequent the area.

Many of the region's swift streams and rivers provide excellent habitat for various salmon and trout species - of course, Endangered Species Act coordination during Clean Water Act permitting is common when it involves those streams and rivers.

Figure 3. Roosevelt Elk Herd That Have Migrated to Lower Level Wetlands During the Winter (photo by Jim Goudzwaard)

As mentioned, the Cascade Range has many high elevation intermittent streams (Figure 4) and, where elevations are flat or with a gentle slope, forested wetlands or wetland meadows that receive their water from snow melt or precipitation runoff may be found. These streams often have more than half of their channel area covered by large woody debris or have overstory canopies that keep the waters cool (Figure 5). Growing seasons can be extremely short at the higher elevations (at higher elevations, less than 60 days) although it is not uncommon to find wetland plants growing under Figure 4. Steep-Gradient Mountain Stream (photo by Corrie Veenstra)elting snow!

Figure 4. Steep-Gradient Mountain Stream (photo by Corrie Veenstra)

Figure 5. A Low-Grade Cascade Mountain Stream Covered With Woody Debris and With an Associated Riparian Corridor (photo by Corrie Veenstra)

As the higher elevation streams and wetlands coalesce, they form perennial streams bordered by diverse riparian zones with many different vegetative strata and edges all in a very small area. These riparian zones transition into the dense forested areas described previously and provide many habitat niches utilized by the Cascade's fauna. At these lower elevations, broad forested wetlands can often be found, generally in association with the perennial streams where slopes are not as steep. It is here that "clear cuts", the result of total site logging, can often be found.

So you may wonder what keeps this approximately 42,000 square mile area from being totally developed. Why do we spend so little regulatory time in the Cascade Range? The answer is quite easy - much of the land is in public ownership with the U.S. Forest Service and Bureau of Land Management being the prime stewards. Of the 14 national forests that cover the Cascade Range, there are four in Washington, seven in Oregon and three in California. In addition, there are four national parks (North Cascades, Mt. Rainier, Crater Lake, Lassen Volcanic), two national monuments (Mt. St. Helens, Newberry Crater National Volcanic), one national scenic area (Columbia River Gorge), countless designated wilderness areas and several Native American tribal lands located in the Cascade Range.

This is not meant to imply that Portland, Seattle and northern California Corp Districts have no permitting actions in the Cascade Range. Highway construction and maintenance within these areas always continues (Figure 6). And logging activities including road construction and maintenance, although dwindling in recent years, still occurs. All the snow in the high mountains attracts a multitude of winter recreational activities giving way to summer time camping, hiking, biking, etc. - all activities that require trails, roads, parking lots, housing and other amenities that might have an impact on waterways and wetlands.

Figure 6. Mountainous Road and Stream Culvert Repair (photo by Susan Sturges)

So when your thoughts stray about all the beauty out here in the west (and especially the Pacific Northwest), just remember ---- it rains here a lot!! We can promise - you won't like it!!!

(Jim Goudzwaard is a Regulatory Specialist in the Portland Districts. His prime interests include wetland evaluation.)

Cows and Ditches make Fen Delineation a Unique Challenge *Or Lessons learned in delineating an impacted, subalpine fen*

Brad Johnson and Tim Carey

Delineation of fens in a natural condition is generally straightforward - their organic soils are clearly hydric and typically saturated at (or near) the surface with groundwater, and vegetation tends to be strongly hydrophytic; but when fens[1], or more broadly mires[2] , are altered by historical or contemporary land uses the picture can be blurred or outright confusing. This situation is exemplified by the Four-Mile Creek Mire (FMCM). In this article we describe some of the challenges we encountered during the delineation of this wetland complex, issues that may be encountered during other mire delineations. We discuss how we addressed the issues, with the hope that this may help save the reader some time and in the end, improve wetland delineation in such atypical cases.

Four-Mile Creek mire is a wetland complex located in South Park, a broad intermountain valley located in the heart of the Colorado Rockies. Here, the term "park" does not refer to a publicly managed area, but is an anglization of the French word parc meaning "game reserve" - a term that alludes to the abundance of game that was present in the valley during the initial phases of European settlement. The Denver Water Board (DWB) owns Four-Mile Ranch on which the main section of mire is situated. Although the boundaries of this expansive, valley-long wetland complex are uncertain as it continues off the property and intermingles with the sinuous riparian corridor of Four-Mile Creek, on the DWB property organic soil (fen) wetlands encompass 48 acres. Intensive cattle grazing has negatively impacted the entire fen and roughly half of the fen has been drained by a large ditch that longitudinally bisects the site. These alterations have caused profound changes in the wetland ecosystem, and much of the former fen area is no longer wetland.

The FMCM is a calcareous wetland. Although fens and mires never constitute a large portion of subalpine habitats, South Park's calcareous mires are truly unique. Groundwater entering these wetlands is highly charged with dissolved minerals, notably calcium and other salts. It is also very alkaline with pHs exceeding 9.0 in places. These conditions create a rare type of wetland commonly classified as an "extremely-rich fen" - a term referring variously to the high species diversity, number of calciphilous (calcium-loving) plants, or mineral richness of these wetlands. The flora and fauna of South Park's fens reflect the uniqueness of the wetland environment and natural history. As a mix of disjunct boreal and local mountain elements, these fens provide habitat for some 15 state or globally rare plant species and a large, but uncertain, number of rare invertebrate species.

Mires[3] , such as those in South Park, also perform a wide array of critical environmental functions, ranging from chemical and physical filtration of water to maintenance of stream base flow and aquatic life use characteristics.

The Project and Regulatory Setting

In spite of their well documented environmental and ecological importance, South Park's fens have been subjected to widespread impacts through peat mining, drainage, and intensive cattle grazing. No fen in the region has been spared from some form of alteration or active utilization. As the importance of these wetlands has been uncovered[4] , there has been an increasing desire to restore or rehabilitate degraded calcareous fens. In addition, Four-Mile Creek and its adjacent mires are notably important, as these areas comprise the headwaters of the South Platte River, a very important source of water for Denver and its associated suburbs.

Denver Water Board (DWB) became aware of the presence of the FMCM after a 2000 wetland survey. Learning that the wetland had been severely impacted by a drainage ditch constructed before their ownership and by long-term, intensive cattle grazing, DWB decided to initiate a restoration project to rehabilitate the degraded wetland. Showing the value of interagency cooperation, the FMCM restoration forms one of the cornerstone projects contributing to a valley-wide restoration effort involving the US Fish and Wildlife Service, Park County, Colorado Division of Wildlife and Colorado Open Lands. In a distinct, but complementary project, these agencies recently reestablished five and a half miles of stream that had been straightened and deeply entrenched.

Foreseeing the potential need for mitigation credits in the Upper South Platte Basin, DWB is proposing FMCM as a mitigation bank. Currently, baseline conditions of the wetland are being quantified and the draft mitigation bank prospectus is being developed. Aside from the obvious ecosystem benefits, a significant focus of the FMCM is on furthering our scientific understanding of the effects of land uses on mires, how to better balance utilization and ecosystem maintenance, and improve mire restoration. As such, an intensive monitoring program has been initiated on the wetland, which includes 16 data logging wells, 10 paired manually read wells and 32 paired permanent monitoring plots in which soil, vegetation and topography are annually evaluated.

Issues and Approaches

During the initial phases of site characterization, and in accordance with mitigation banking procedures, a delineation of the wetland boundary was required. This delineation entailed delineation of jurisdictional and non-jurisdictional wetlands and the historical extent of the mire and the organic soil fen within.

The Four-Mile Creek Mire provides a fine illustration of problematic fen and mire delineation. Because of an extensive, quantitative data set, the FMCM is a laboratory for studying delineation of atypical fen and mire conditions. What follows is a brief overview of the problems we encountered in delineating our various boundaries and the solutions we developed.

Soils

Histosols only form where soils are essentially saturated in perpetuity. Consequently, Histosols are by default classified as hydric soils. Yet many of the FMCM soils have been artificially drained to the point that they are no longer functionally hydric. Since other types of redoximorphic features do not generally form in these organic soils, the typical indicators of functional hydric soils do not exist. When water tables grade very subtly it is challenging to determine where soils begin to take on hydric conditions.

When Histosols are drained they become aerobic and the soils begin to decompose and oxidize, or literally, "burn off". Oxidized organic soils lose their fibrous macro-structure and turn to a fine, light organic dust (Figure 1). These soils also tend to develop a lighter chroma and become ashen, particularly when underlying mineral soils are salty. In delineating wetland boundaries at FMCM we found that the depth of soil oxidation was a key indicator of hydric conditions. By comparing data from over 300 soil samples to fine-scale hydrologic data and topographic maps (6 in. accuracy), we found that organic soil oxidation within the upper 12 in. provided a positive indicator of significant drainage and a lack of hydric conditions.

Figure 1. A 32 in. soil profile showing oxidizing organic soils. To the left is the profile bottom which shows a thin layer of normal, well decomposed (sapric) peat. Just above, the dark peat is oxidized and lighter in color. About half way up the profile the structure of the peat becomes more fibrous and color becomes buff. This section of the profile is strongly oxidized

The Interaction of Hydrology and Microtopography

Water table depth is arguably the most influential aspect of the wetland environment. The soil's surface elevation is, of course, the common reference in determining water table depth, but at FMCM this elevation routinely varies by more than 18 in. over distances of just a few inches, owing to a strong pattern of microtopography. In cases such as this, the idea of single soil surface elevation is really reduced to an abstraction (Figures 2a & b), yet from a delineation standpoint this is a critical issue.

Detailed consideration of the genesis, morphology, and character of fen microtopography has helped shed some light on this issue. Fens characteristically have irregular surfaces caused by the development of microtopography. In mountain fens the most common microtopographical pattern is one of hummocks and hollows, in which low mounds (hummocks) grow up from the fen surface owing to localized improvement of growing conditions and the resultant increase in organic matter production. In this situation, hollows between the hummocks are not typically depressions, but rather constitute the base level of the fen (Figure 3a). Under these natural circumstances, the elevations of the hollows most commonly act as the reference surface for water table measurements.

Figure 2a. Grazing-induced microtopography. Notice the troughs are deeper than the ecologist's knees. Here, measuring water table depth from the ridges would indicate a lack of wetland hydrology, while measuring from troughs yields a positive result. This photograph was not taken at the FMCM, rather it is of a grazing impacted fen in northern Colorado.

Figure 2b. Grazing induced microtopography at the FMCM. In this area coverage of ridges and troughs is nearly equal. Notice the steep, bare faces of the ridges.

In fens subjected to intensive grazing, such as the FMCM, the notion of reference surface commonly becomes muddled. Under these circumstances microtopography development is turned on its ear - instead of hummocks and hollows, ridges and troughs form. These forms of microtopography look grossly similar, but each has a different genesis, form and ecological character. Troughs develop from the erosion and compaction that accompanies the creation of cattle trails (Figure 3b). When trails parallel one another, a ridge of the original fen surface remains, separating the two incised troughs. After years of grazing, troughs develop a dense criss-cross pattern to the point that an area is mostly "trough" and the original fen surface only remains as isolated rises (Figures 2b and 4). Here the conundrum is, which surface should be used as the reference for determining water table depth? This is a key decision, since commonly a measurement from the trough surface shows wetland hydrology, while an adjacent ridge top (the historical fen surface) does not.

Figure 4. View east along a grazed and dewatered section of the FMCM. Here, little of the fen's historical surface remains having been eroded by cattle (and wind). The linear orientation of broken ridges is particularly evident at the center of the photograph. The line of broken ridges follows a relic fence line and parallel cattle-induced troughs can be seen on either side.

In general, the first step in evaluating the presence of wetland hydrology should be to determine whether microtopography is primarily natural or cattle-induced. Of course, if a site is known to be ungrazed this is easy. When a site has been, or is actively, grazed, microtopography must be closely assessed, since the natural and artificial situations can look superficially quite similar. What follows is a list of indicators suggestive of grazing-induced microtopography.

Lack of vertical growth - In natural situations, hummocks grow upwards and the bases of perennial vegetation, particularly shrubs, become engulfed by the expanding mound (Figure 5a). The ridges of grazing-induced microtopography typically have a well-defined surface with no sign of hummocks engulfing the base of perennial vegetation (Figure 5b).

Steep, bare faces - Natural hummocks generally take on the shape of roundish mounds with relatively low angle sides covered with vegetation. Grazing-induced ridges are usually steeply sided or even undercut, and the sides have sparse vegetation owing to the strike of hooves down the faces (Figure 2b).

Linear orientation of troughs - Troughs originate as trails, thus they tend to be somewhat linear features. Although the linearity is commonly masked by the number of criss-crossing trails, it can often be detected by sighting down a particular trough and seeing if it lines up well with other troughs. Old fence rows or other features can often help in making this determination, too (Figure 4).

Figure 5a - An example of a natural hummock found in North Park near Walden, CO. Notice how mosses and mounded biomass engulf perennial vegetation.

Figure 5b. Cross-section cut through a grazing-induced, oxidizing ridge. Normal peat is seen at the bottom of the profile (dark colored). Oxidized peat is lighter brown. The peat near the top of the profile is oxidizing and also shows an accumulation of precipitated salts. Notice the vegetation growing directly out of the surface of the ridge and no incorporation of discernable plant material in the center.

If microtopography is determined to be grazing induced, it is then incumbent upon the delineator to determine the appropriate reference elevation for water table determinations; i.e., should water table depth be measured from ridge tops, trough bottoms or some point in between. The most conservative approach would measure water table depth from the trough bottoms. The resultant delineation would consist of numerous small wetlands intermingled with equally small uplands - a delineator's nightmare to perform and map. A second approach would be to measure the depth to the water table based on the historical fen surface, which would be the ridge tops. This approach would be equally difficult to perform and map, as well as resulting in the inclusion of uplands within the delineation. For this atypical situation, the authors suggest an alternative approach of creating an average, or "virtual", surface based on a combination of trough coverage and depth. So, for example, an area that has 60% troughs, with an average trough-depth of 35 cm, would have a virtual depth to the water table of 21 cm above the trough bottom. (0.6 x 35 = 21). Of course, in the case of FMCM, if the area had only been grazed and not drained via the ditch, hydrology would likely be easily identifiable, with the troughs filled with water.

Vegetation

In situations where fens have been drained, vegetation often provides an ambiguous indicator of wetland conditions, since well-established perennial wetland vegetation can often persist long after hydrologic alteration has occurred. Such is the case at the FMCM. In drained areas vegetation is typically made up of FAC species with approximately equal numbers of obligate wetland and obligate upland species. In areas without significant grazing-induced microtopography these species mix together, but where microtopography exists, ridge tops are commonly covered with FAC and obligate upland species whereas adjacent troughs are dominated by obligate wetland species.

When vegetation composition is so borderline, evaluation of this parameter is sketchy. In general, we suggest approaching hydrophytic vegetation determination using the same philosophy as in water table elevation - evaluate the type of vegetation growing on a representative sample of the troughs and ridges and apply the resultant vegetative dominance determination to the entire area reflecting these distinct conditions.

These approaches worked well at the FMCM, but we do caution the reader that in atypical situations such as these, no cookbook, one-size-fits-all approach exists. At all times the expertise of agency personnel, consultants, and scientists should be brought to bear on the problem. While various solutions may be formulated, perhaps the most important point is that the methodology be well documented and consistently applied.

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1 Fens are organic soil wetlands whose primary water source is groundwater.

2 Mire is a general term for a wetland complex that includes organic soils (fen) within its contiguous boundary. Mires commonly include mineral soil salt flats, willow carrs, riparian areas, and wet meadows intermixed with organic soil habitats.

3 The organic soil portion of these wetlands - the fen proper - is often only a part of a much larger, interdependent wetland ecosystem that commonly includes mineral soil salt flats, willow carrs, riparian areas, and wet meadows. In such cases the entire wetland complex, including both mineral and organic soil portions, is rightfully termed a "mire".

4 On June 8, 1998, Region 6 of the US Fish and Wildlife Service (Service) established a regional policy on the protection of fens. With this policy, the Service designated all functioning fens within Region 6 Resource Category 1, in accordance with the Service's "Mitigation Policy". The mitigation goal for Resource Category 1 is no loss of existing habitat value. Consequently, the Corps Districts in Colorado revoked use of most Nationwide Permits in fens.

(Brad Johnson, Ph.D., is a wetland consultant with his own consulting company, Johnson Environmental Consulting, in Fort Collins, CO. Tim Carey is chief of the Denver Regulatory Office in the Omaha District.)

Also of Interest

Nationwide Permits. Headquarters has published a proposal to amend the Nationwide permits (NWP) regulations by removing the two-year limit for NWP verification letters and changing the 30-day pre-discharge notification to a 45-day pre-construction notification. The proposed amendment, if adopted, would allow issuance of NWP verification letters that are valid until the NWP expires. The comment period for this proposal ends on January 31, 2005. The notice is posted on HQ Regulatory's "Latest News" web page. The notice can be retrieved from:
http://www.usace.army.mil/inet/functions/cw/cecwo/reg/Amend330propFR.pdf
(David Olson, CECW-MVD)

Instream Flows for Riverine Resource Stewardship - published by the Instream Flow Council. Chandler Peter (Omaha District

Regulatory Branch, Wyoming Field Office) recommended this book to us, noting that as with other aspects of the regulatory arena, the evaluation and management of instream flows has become increasingly complicated. He indicated that this book pulls together the numerous facets associated with instream flow management. The book begins with a focus on the factors or components (hydrology, geomorphology, biology, water quality, and connectivity) that must be considered in developing instream flow programs and site-specific prescriptions. It includes an extensive chapter on legal aspects of instream flow presecriptions including public trust doctrine, water rights, agency roles, and water quality standards. It includes a chapter devoted to development of instream flow programs and site-specific prescriptions. It also discusses many instream flow assessment tools, including those developed to assess hydrology, geomorphologic, or biological conditions, as well as composite tools. It provides a framework for regulators to consider when dealing with projects that involve modifications to stream flows as well as stream mitigation proposals. Chandler Peters recommends purchasing a copy for the office library.

Humor from the Field

The newsletter encourages regulators in the field to submit humorous field experiences. The following was submitted for the newsletter:

I was on a field trip with another project manager from the Utah Field Office looking for a site where someone applied for a state Stream Alteration Permit for relocating a stream. The stream was in a narrow canyon and the project was of considerable length. With drawing in hand, we drove up the canyon looking on the right side for the site and down the canyon looking on the left without finding any of the physical features shown on the map. Finally, after driving up and down the canyon several times, we pulled over at the bottom to decide if we were in the wrong canyon. We looked at the map in my lap and, in exasperated/amused voices, we said at the same time, "The map's upside down". Oddly enough, the next time up the canyon we found the site and the mantra of the office became "North is UP" (for those of us who are map-challenged).
(Katherine Trott, Senior Project Manager, HQ Regulatory)

(The editor notes another lesson may be relevant for this field experience-when preparing maps, provide easily discernible directional indicators, e.g., a north arrow.)

Newsletter Communication

To comment on the newsletter, suggest topics, submit an article, or suggest events or articles of interest, please contact Bob Brumbaugh at:

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